

layer coupling the pair of ferromagnetic films to each other may comprise Ru and its thickness may fall between 0.8 nanometers and 1.2 nanometers.

In a second aspect, the present invention provides a magnetoresistance effect device comprising a nonmagnetic spacer layer, a first ferromagnetic layer and a second ferromagnetic layer as separated by the nonmagnetic spacer layer, in which the magnetization direction of the first ferromagnetic layer differs from that of the second ferromagnetic layer when the applied magnetic field is zero, and a nonmagnetic high-conductivity layer adjacent to the first ferromagnetic layer on the plane opposite to the plane at which the first ferromagnetic layer is contacted with the nonmagnetic spacer layer, in which the thickness of the nonmagnetic high-conductivity layer and the thickness of the ferromagnetic layer are so designed that the wave asymmetry,  $(V1 - V2)/(V1 + V2)$ , in which V1 indicates the peak value of the reproduction output in a positive signal field and V2 indicates the peak value of the reproduction output in a negative signal field, falls between minus 0.1 and plus 0.1.

For attaining the wave asymmetry of falling between minus 0.1 and plus 0.1, it may not be always necessary to employ the constitution of SyAF in the device but also a single layer. In that case, it is desirable that the second ferromagnetic layer of a single layer may have a magnetic thickness of from

0.5 nanometer Tesla to 3.6 nanometer Tesla. If the magnetic thickness of the single layer of the second ferromagnetic layer is larger than 3.6 nanometer Tesla, it may be difficult to attain the wave asymmetry noted above. On the other hand, if it is smaller than 0.5 nanometer Tesla, the MR ratio in the device will be noticeably small.

In a third aspect, the present invention provides a magnetoresistance effect device comprising a nonmagnetic spacer layer, first and second ferromagnetic layers separated by the nonmagnetic spacer layer, in which the magnetization direction of the first ferromagnetic layer differs from that of the second ferromagnetic layer when the applied magnetic field is zero, and a nonmagnetic high-conductivity layer adjacent to the first ferromagnetic layer on the plane opposite to the plane at which the first ferromagnetic layer is contacted with the nonmagnetic spacer layer and that the device satisfies the conditions of  $0.5 \text{ nanometers} \leq t_m(\text{pin}) + t(\text{HCL}) \leq 4 \text{ nanometers}$  and  $t(\text{HCL}) \geq 0.5 \text{ nanometers}$ , in which  $t(\text{HCL})$  indicates the thickness of the nonmagnetic high-conductivity layer in terms of copper having a specific resistance of  $10 \mu\Omega\text{cm}$ , and  $t_m(\text{pin})$  indicates the magnetic thicknesses of the second ferromagnetic layer, respectively, in the second ferromagnetic layer in terms of saturation magnetization of 1Tesla.

Satisfying the conditions noted above, the MR device

may realize the wave asymmetry falling between minus 0.1 and plus 0.1 and high MR, even when the second ferromagnetic layer therein is a single layer.

In a fourth aspect, the present invention provides a magnetoresistance effect device comprising a pinned magnetic layer and a free layer as separated by a nonmagnetic spacer layer disposed therebetween, and an antiferromagnetic layer as laminated on the pinned magnetic layer for pinning the magnetization of the pinned magnetic layer, the pinned magnetic layer comprises a pair of ferromagnetic layers, a ferromagnetic layer A as disposed adjacent to the nonmagnetic spacer layer and a ferromagnetic layer B as disposed adjacent to the antiferromagnetic layer, that those ferromagnetic layers A and B are antiferromagnetically coupled to each other via an antiferromagnetically coupling layer existing therebetween, and that the close-packed plane of the antiferromagnetic layer is so oriented that the half-value width of the diffraction peak from the closed packed plane of the layer in its rocking curve appears at  $8^\circ$  or smaller.

In a fifth aspect, the present invention provides a magnetoresistance effect element comprising a nonmagnetic spacer layer, and first and second ferromagnetic layers separated by the nonmagnetic spacer layer, a magnetization direction of the first ferromagnetic layer being at an angle relative to a magnetization direction of the second